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(54) PHASE CHANGE HEAT STORAGE DEVICE

(57) The present invention discloses a novel phase change heat storage device, comprising a housing, wherein the housing is internally provided with a lining; an insulating layer is disposed between the lining and the housing; the lining is internally filled in with a phase change material; a coiled pipe is embedded in the phase change material; the inlet and outlet of the coiled pipe both extend out of the lining and are respectively welded with and communicate with a main water inflow pipe and a main water outflow pipe, so all welds between the coiled pipe and the main water inflow pipe and main water outflow pipe are positioned outside the lining and are not soaked by the phase change material. The lining is provided with at least one partition board; the partition board divides the inner space of the lining into independent spaces such that the phase change material is respectively positioned in the independent spaces divided by the partition board. Compared with the prior art, the present invention has a simple and novel structure design, solves the defects of existing phase change heat storage devices, greatly improves the heat exchange effect of the phase change heat storage device,

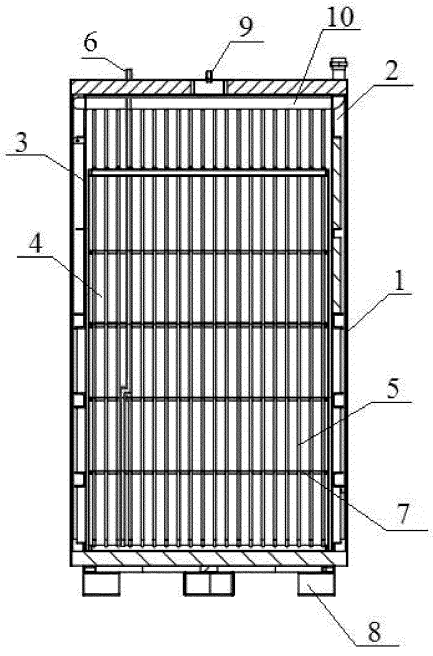

FIG. 1

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Description

BACKGROUND OF THE INVENTION

Technical field

[0001] The present invention relates to the field of heat storage, in particular to a novel phase change heat storage device.

2. Description of the Related Art

[0002] Existing phase change heat storage devices are still immature in structural design of lining and coiled pipe components, so the internal heat exchange components in the heat storage devices exchange heat non-uniformly, and the utilization of phase change materials are insufficient, so the existing phase change heat storage devices have a low heat exchange efficiency, indirectly increasing the production cost of the devices. The existing phase change heat storage devices have the defect that welds between the pipes in the heat exchange component and the main flow path are soaked in the phase change materials, thus the welds become corroded by the phase change materials and generate fatal damage, and the welded parts soaked in the phase change materials are inconveniently maintained after being damaged, causing a relatively short service life to the existing phase change heat storage devices. Finally, the choices of users are affected.

BRIEF SUMMARY OF THE INVENTION

[0003] The objective of the present invention is to provide a novel phase change heat storage device which has a high heat exchange efficiency and a long service life to overcome defects in the prior art.

[0004] The objective of the present invention can be fulfilled by the following technical solution:

A novel phase change heat storage device includes a housing, wherein the housing is internally provided with a lining; an insulating layer is disposed between the lining and the housing; the lining is internally filled in with a phase change material; a coiled pipe is embedded in the phase change material; the inlet and outlet of the coiled pipe both extend out of the lining and are respectively welded with and communicate with a main water inflow pipe and a main water outflow pipe, so all welds between the coiled pipe and the main water inflow pipe and main water outflow pipe are positioned outside the lining and are not soaked by the phase change material.

[0005] The lining is provided with at least one partition board; the partition board divides the inner space of the lining into independent spaces such that the phase change material is respectively positioned in the independent spaces divided by the partition board, thus improving the heat exchange efficiency of the phase change heat storage device and prolonging the service life of the phase change material.

[0006] The partition board is formed with a through-hole wherein the coiled pipe runs through, and the partition board is held at the middle portion of the coiled pipe.

[0007] The device is also provided with a pneumatic stirring mechanism which pneumatically stirs the phase change material.

[0008] The lining is formed with a vent hole, which communicates with the external air, at the top end, ensuring that the whole device works under normal pressure.

[0009] A temperature detecting blind pipe for measuring the temperature of the phase change material is embedded in the phase change material, and disposed on a line which connects the central hole of the device and a corner edge.

[0010] The coiled pipe is a copper pipe.

[0011] The insulating layer is any one or any combination of several ones of a foamed polyurethane layer, an aerogel insulating layer, an inorganic nano insulating layer and a VIP vacuum insulating board.

[0012] The housing shape can be cylindrical, square or plate-like.

[0013] A base is disposed below the housing.

[0014] The novel phase change heat storage device can achieve the following functions in actual applications.

[0015] Heat charging: industrial waste heat or boiler heat is used to heat water; then the hot water flows through the coiled pipe to heat the phase change materials; after the phase change materials absorb the heat, the temperature gradually rises to the phase-change temperature point; phase change material changes in phase and continuously absorbs heat; after the phase is completely changed, the material can continuously absorb the heat and rise in temperature. Thus, the heat storage process is completed.

[0016] Heat release: when hot water is needed, a valve switch is controlled to drive cold water to flow through the coiled pipe, and the cold water absorbs heat from the heat exchange material to become hot water which can be used by people, achieving the instant heating function. As the cold water continuously absorbs heat, the temperature of the phase change material drops, and the phase change material changes phase at the phase-change temperature point and releases latent heat. During and after the phase change, the temperature of the phase change material drops continuously and the phase change material releases heat, completing the heat release process.

[0017] Compared with the prior art, the novel phase change heat storage device of the present invention optimizes the design structure of the coiled pipe component for heat exchange, avoiding the defect that the welds in the existing phase change heat storage device are soaked in the phase change material. The present invention makes the post-maintenance of the phase change heat storage device more convenient and feasible and prolongs the service life of the phase change heat storage device. Moreover, the lining is internally provided with

the partition board which divides the phase change material into multiple sections, improving the heat exchange effect of the phase change heat storage device and reducing the production cost of the phase change heat storage device. The present invention employs additional reinforcing structures and protective measures, ensuring the stability and use safety of the phase change heat storage device during working.

[0018] The present invention has a simple and novel structure design, solves the defects of existing phase change heat storage devices, greatly improves the heat exchange effect of the phase change heat storage device, reduces the production cost of the device, and prolongs the service life of the device.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0019]

FIG. 1 is a structural view of a phase change heat storage device of the present invention;
FIG.2 is a structural view of a coiled pipe in the lining.

[0020] In the figures, 1-housing; 2-insulating layer; 3-lining; 4- phase change material; 5-coiled pipe; 6-temperature detecting blind pipe; 7-partition board; 8-base; 9-vent hole; 10-main water inflow pipe; 11-main water outflow pipe.

DETAILED DESCRIPTION OF THE INVENTION

[0021] The present invention is described in detail with reference to the attached drawings and embodiment.

Embodiment

[0022] A novel phase change heat storage device, as shown in FIG.1 and FIG.2, includes a housing 1, wherein the housing 1 is internally provided with a lining 3; an insulating layer 2 is disposed between the lining 3 and the housing 1; the lining 3 is internally filled in with a phase change material 4; a coiled pipe 5 is embedded in the phase change material 4; the inlet and outlet of the coiled pipe 5 both extend out of the lining 3 and are respectively welded with and communicate with a main water inflow pipe 10 and a main water outflow pipe 11, so all welds between the coiled pipe 5 and the main water inflow pipe 10 and main water outflow pipe 11 are positioned outside the lining 3 and are not soaked by the phase change material 4. In the present invention, the lining is provided with at least one partition board 7; the partition board 7 divides the inner space of the lining 3 into independent spaces such that the phase change material 4 is respectively positioned in the independent spaces divided by the partition board 7, thus improving the heat exchange efficiency of the phase change heat storage device and prolonging the service life of the phase change material. The partition board 7 is formed with a through-hole which the coiled pipe 5 runs through, and the partition board 7 is held at the middle portion of the coiled pipe 5. The coiled pipe 5 is a copper pipe. The lining 3 is formed with a vent hole 9, which communicates with the external air, at the top end, ensuring that the whole device works under normal pressure. The housing shape can be cylindrical, square or plate-like. A base 8 is disposed below the housing 1.

[0023] The insulating layer 2 is any one or any combination of several ones of a foamed polyurethane layer, an aerogel insulating layer, an inorganic nano insulating layer and a VIP vacuum insulating board. Upon demands, the device is also provided with a pneumatic stirring mechanism which pneumatically stirs the phase change material 4. A temperature detecting blind pipe 6 for measuring the temperature of the phase change material is embedded in the phase change material 4, and disposed on a line which connects the central hole of the device and a corner edge.

[0024] The novel phase change heat storage device of the present invention can achieve the following functions in actual applications.

[0025] Heat charging: industrial waste heat or boiler heat is used to heat water; then the hot water flows through the coiled pipe to heat the phase change materials; after the phase change materials absorb the heat, the temperature gradually rises to the phase-change temperature point; phase change material changes in phase and continuously absorbs heat; after the phase is completely changed, the material can continuously absorb the heat and rise in temperature. Thus, the heat storage process is completed.

[0026] Heat release: when hot water is needed, a valve switch is controlled to drive cold water to flow through the coiled pipe, and the cold water absorbs heat from the heat exchange material to become hot water which can be used by people, achieving the instant heating function. As the cold water continuously absorbs heat, the temperature of the phase change material drops, and the phase change material changes phase at the phase-change temperature point and releases latent heat. During and after the phase change, the temperature of the phase change material drops continuously and the phase change material releases heat, completing the heat release process.

[0027] With the description of the above embodiments, those ordinarily skilled in the art can understand and use the present invention. Those skilled in the art can easily make various amendments to the embodiments and apply the general principle described here to other embodiments without inventive labor. Therefore, the present invention is not limited to the above embodiments. All improvements and amendments made by those skilled in the art according to the enlightenment of the present invention should fall within the protective scope of the present invention.

Claims

1. A novel phase change heat storage device, comprising a housing (1), wherein the housing (1) is internally provided with a lining (3), an insulating layer (2) is disposed between the lining (3) and the housing (1); the lining (3) is internally filled in with a phase change material (4); a coiled pipe (5) is embedded in the phase change material (4); **characterized in that** the inlet and outlet of the coiled pipe (5) both extend out of the lining (3) and are respectively welded with and communicate with a main water inflow pipe (10) and a main water outflow pipe (11).

2. The novel phase change heat storage device according to claim 1, **characterized in that** the lining is internally provided with at least one partition board (7); the partition board (7) divides the inner space of the lining (3) into independent spaces such that the phase change material (4) is respectively positioned in the independent spaces divided by the partition board (7).

3. The novel phase change heat storage device according to claim 2, **characterized in that** the partition board (7) is formed with a through-hole which the coiled pipe (5) runs through, and the partition board (7) is held at the middle portion of the coiled pipe (5).

4. The novel phase change heat storage device according to claim 1, **characterized in that** a pneumatic stirring mechanism which pneumatically stirs the phase change material (4) is also provided.

5. The novel phase change heat storage device according to claim 1, **characterized in that** the lining (3) is formed with a vent hole (9), which communicates with the external air, at the top end.

6. The novel phase change heat storage device according to claim 1, **characterized in that** a temperature detecting blind pipe (6) for measuring the temperature of the phase change material is embedded in the phase change material (4), and disposed on a line which connects the central hole of the device and a corner edge.

7. The novel phase change heat storage device according to claim 1, **characterized in that** the coiled pipe (5) is a copper pipe.

8. The novel phase change heat storage device according to claim 1, **characterized in that** the insulating layer (2) is any one or any combination of several ones of a foamed polyurethane layer, an aerogel insulating layer, an inorganic nano insulating layer and a VIP vacuum insulating board.

9. The novel phase change heat storage device according to claim 1, **characterized in that** a base (8) is disposed below the housing (1).

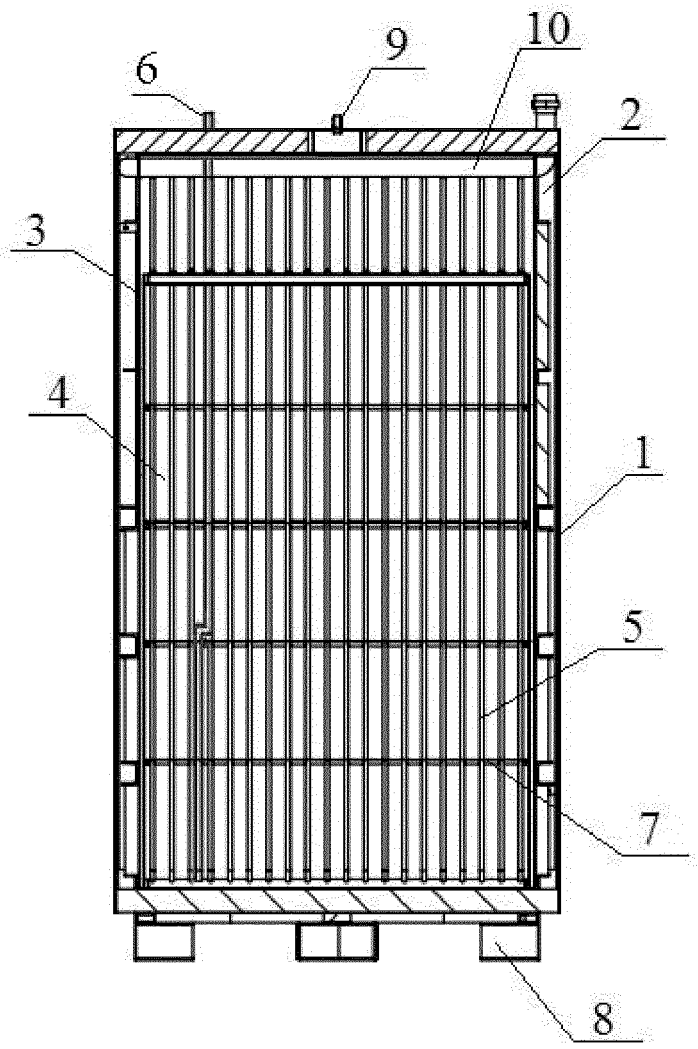

FIG. 1

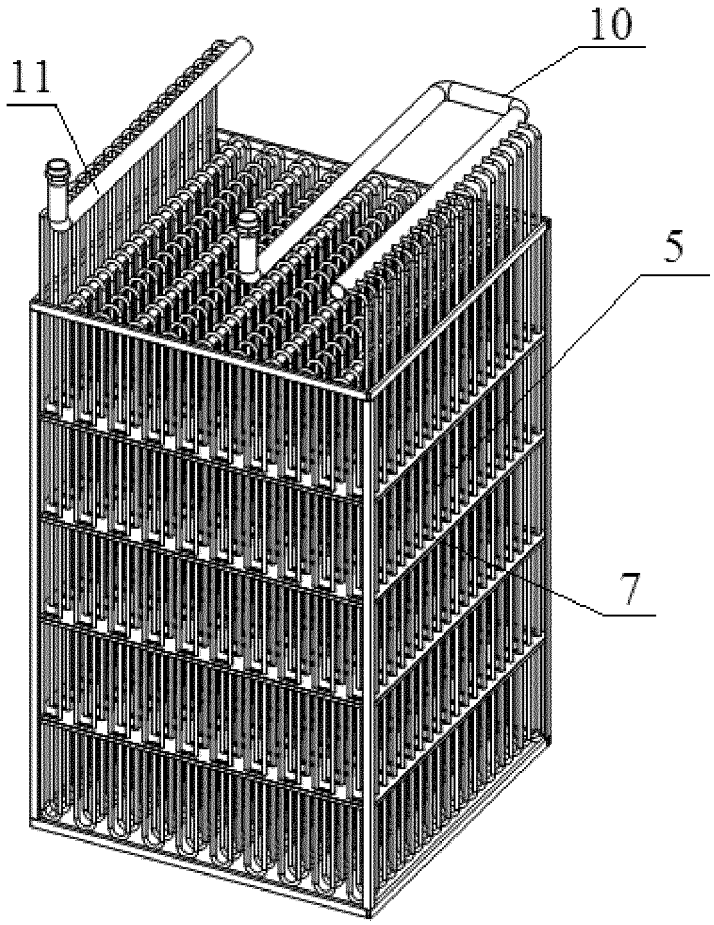

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/072751

A. CLASSIFICATION OF SUBJECT MATTER

F28D 20/02 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F28D 20; F28D 17

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNKI, CNPAT, EPODOC, WPI: coil pipe, phase change, heat storage, thermal storage, accumulation of heat, coil, pipe, clapboard, baffle, separator

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 204902647 U (JIANGSU PIONEER ENERGY CO., LTD.), 23 December 2015 (23.12.2015), claims 1-9	1-9
PX	CN 105021076 A (JIANGSU PIONEER ENERGY CO., LTD.), 04 November 2015 (04.11.2015), claims 1-9	1-9
Y	CN 1719185 A (WANG, Zhihui), 11 January 2006 (11.01.2006), description, page 2, line 31 to page 3, line 35, and figure 1	1-3, 5-9
Y	CN 103185367 A (QINGDAO AOHUAN NEW ENERGY SCIENCE & TECHNOLOGY DEVELOPMENT CO., LTD.), 03 July 2013 (03.07.2013), description, paragraphs [0021]-[0026], and figure 1	1-3, 5-9
A	CN 103090712 A (SHANGHAI JIAOTONG UNIVERSITY), 08 May 2013 (08.05.2013), the whole document	1-9
A	WO 2015072503 A1 (IBIDEN CO., LTD.), 21 May 2015 (21.05.2015), the whole document	1-9

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 March 2016 (16.03.2016)	**06 May 2016 (06.05.2016)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **DONG, Tongyong** Telephone No.: (86-10) **62084866**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2016/072751

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 204902647 U	23 December 2015	None	
CN 105021076 A	04 November 2015	None	
CN 1719185 A	11 January 2006	None	
CN 103185367 A	03 July 2013	None	
CN 103090712 A	08 May 2013	None	
WO 2015072503 A1	21 May 2015	None	

Form PCT/ISA/210 (patent family annex) (July 2009)